CSF Analysis in suspected cases of meningitis in adult patients at Rural Hospital

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Abstract:
Introduction : The term Meningitis is used to describe an inflammatory infection of the membranes surrounding the brain and spinal cord, which occurs as either a primary disease or secondarily to disease in some other part of the body. The diagnosis is primarily confirmed by analyzing cerebrospinal fluid (CSF). Early diagnosis of the cause may be based on the cytological, biochemical parameters, Gram stain, ZN stain and KOH preparation. Materials and Methods: This is a Descriptive cross sectional study which was carried out from January 2022 to June 2022 in Central Clinical Laboratory (CCL), Dr.BVPRMC, Loni. The study included adult patients (>14 Years) who have clinical symptoms of headache, neck stiffness, photophobia, fever, rashes, seizures and CSF sent to the CCL. Results: The study showed 28 cases of bacterial meningitis. 37 cases of viral meningitis, 1 case of fungal meningitis and other 32 cases were showing normal CSF findings. All types of meningitis were more common in males. Viral meningitis was common in younger age group. Bacterial meningitis TLC count varied from 5 to 1000/cumm while viral meningitis count varied from 5 to 30/cumm. In viral meningitis all cases showed lymphocytosis. In bacterial meningitis glucose level was found much lower than that of viral meningitis. Proteins were increased in all meningitis. Gram stain and culture were positive in 27 of 28 case of bacterial meningitis. 1 bacterial meningitis case was diagnosed on the basis of TLC, DLC and Glucose level. Conclusion: CSF Findings are useful in identifying meningitis and differentiating it into bacterial, viral, fungal and tuberculous cause.

Keywords: CSF, Meningitis , Bacterial , Viral.

INTRODUCTION

Cerebrospinal fluid is a clear fluid which is form as a ultrafiltrate of plasma. CSF is present in both the intracranial and the spinal compartments. It is continuously being secreted by the choroid plexus at a constant rate inside the ventricles of brain and circulate in the subarachnoid space of the brain and spinal cord through CSF pathway. The total volume of CSF in adults is approximately 140 ml. The main function of CSF is to reduce buoyancy of brain. It also supplies nutrient as well as helps in removal of various substances like amino acids, neurotransmitters, metabolic byproducts and cells [(1)].

Acute meningitis is a common cause of morbidity and mortality worldwide. Globally, It is estimated that at least 1.2 million cases of meningitis occurs every year, most in the developing countries [(2)]. Viral meningitis is more common and bacterial meningitis is more severe. About 5-20% of meningitis is caused by bacteria. Fungi and parasites may also cause meningitis.[(3)]

Headache, Neck stiffness, photophobia are the classic symptoms of meningitis but other symptoms like fever, diarrhea, rash may be present[(4)]. Death is not uncommon and many who survive are left permanently disabled, so accurate initial diagnosis is the corner stone for the therapeutic decision making of acute meningitis [(5)]. Appropriately interpreted tests can make cerebrospinal fluid a critical tool in diagnosis and differentiation of variety of diseases. [(6)].

A probable case of bacterial meningitis has CSF with turbid appearance, elevated protein, decreased glucose, leukocytosis with neutrophils. A confirm case of bacterial meningitis is in which the organism causing the infection is identified in CSF by culture, gram stain or ZN stain [(2)].

In bacterial infections the cell response is predominantly of polymorphs of number up to 2000 x 10^6/l. In viral meningitis the response is mainly lymphocytic with cell count in the range 50-250 and occasionally upto 1500 x 10^6/ l. [(7)]

An increase in total protein is the commonest chemical abnormality in CSF and results from breakdown of blood-CSF and Brain-CSF barriers usually as a consequence of inflammatory reaction but occasionally if the flow of CSF is obstructed. Albumin is still dominant protein but depending on abnormality Globulins appear in varying amount.[(7)]

Glucose concentration in CSF is normally lower than in blood, and the most important abnormality is further reduction in glucose content, larger volume of CSF is often used than for blood. In bacterial meningitis glucose may disappear completely but in tuberculous meningitis it may be between 10-40mg/100ml. In viral meningitis glucose concentration is often normal.[(7)]

OBJECTIVE:

1) To evaluate gross apperance of CSF, biochemical changes like glucose and proteins, microscopic findings like leukocytes, gram stain, ZN stain and KOH Mount.
2) To distinguish the types of meningitis weather it is acute bacterial, viral, Fungal or tuberculous meningitis.
3) To describe CSF findings in meningitis along with Age, Sex and clinical findings of patient

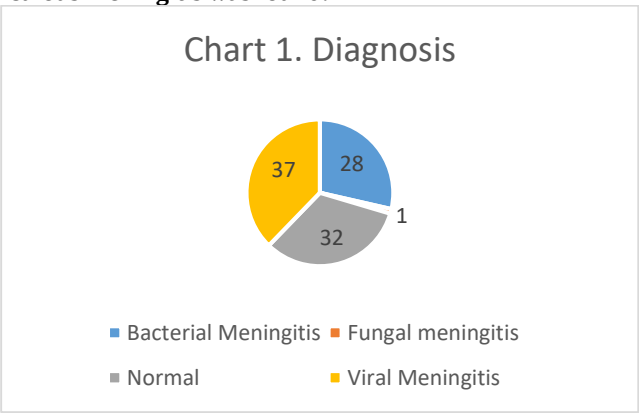
Material and Methods

This was a retrospective observational study at a tertiary care centre in a rural setup. The study included adults patients > 14 years who have clinical symptoms of headache, neck stiffness, photophobia, fever, rashes, seizures.CSF was collected in CCL, In Plain Bulb(Tube 1) For Chemistry (glucose and protein), In Plain Bulb(Tube 2): For Microbiology (Gram's staining, ZN stain and KOH

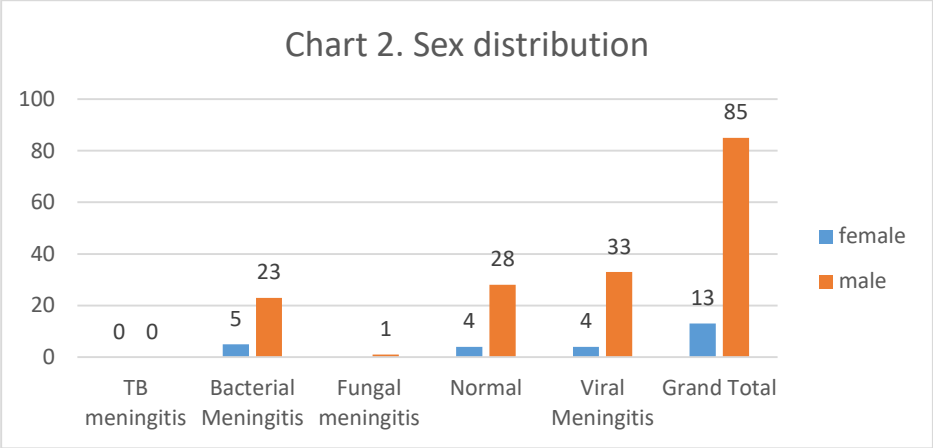
Mount), In EDTA Bulb(Tube 3): For Haematology (Total cell count and differential count).After evaluating above findings in CSF fluid, we interpreted the types of meningitis. Cell count in CSF and differential count was done by XN Series and XNL series hematology analyser and confirmed on Neuber's chamber. For evaluation of CSF Protein; The VITROS PROT slide method was performed using VITROS PROT slides and the VITROS chemistry products. For Evaluation of CSF Glucose, The VITROS GLU slide method was performed using the VITROS GLU slides and the VITROS Chemistry Products. Gram Staining , ZN Staining and KOH Mount was performed on all CSF samples.

Results:

(Chart 1) Out of total 98 suspected cases of meningitis, 37 cases were diagnosed viral meningitis followed by 32 cases; which showed normal CSF findings. 28 cases of bacterial meningitis were diagnosed. Only 1 case of fungal meningitis was found in the present study. No case of tuberculous meningitis was found.



(Chart 2) Out of total 98 cases 85 patients were male and 13 were female. Male predominance was seen in the study. 33 males were diagnosed with viral meningitis followed by 23 males diagnosed with bacterial meningitis and 1 male had fungal meningitis.



(Table 1) Out of total 98 suspected cases; 33 cases were in the age group of 14-20 years followed by 23 each cases in 21-40 years and 41-60 years age group. 19 cases were in the age group above 60 years.

Table 1. Age distribution

Diagnosis	**14-20**	**21-40**	**41-60**	**>60**	**Grand Total**
Bacterial Meningitis	4	8	9	7	28
Fungal meningitis	0	0	1	0	1
Normal	16	8	5	3	32
Viral Meningitis	13	7	8	9	37
Grand Total	**33**	**23**	**23**	**19**	**98**

(Table 2) Out of total 28 cases of bacterial meningitis; 18 cases were was positive for gram positive cocci and 9 cases were positive for gram negative cocci. 1 case of bacterial meningitis was negative for gram staining.

Table 2. Gram staining

Diagnosis	**Gram positive cocci**	**Gram negative cocci**	**Negative for gram stain**	**Grand Total**
Bacterial Meningitis	18	9	1	28
Grand Total	**18**	**9**	**1**	**28**

(Table 3) Glucose values were seen decreased in bacterial meningitis compared to that of viral and fungal meningitis. Protein values were seen increased in all bacterial, viral and fungal meningitis.

Table 3. Glucose level (mg/dl)				
	20-40	**40-80**	**>80**	**Grand Total**
Diagnosis				
Bacterial Meningitis	18	9	1	28
Grand Total	**18**	**9**	**1**	**28**

Discussion

(Table no. 4) In present study, mean age of the patients diagnosed with bacterial meningitis is 44.67 years compared to that of Jiménez Caballero et al 2011 and Aldriweesh M et al 2020 which was 55 and 55.9 years respectively. Male predominance (4.5 :1)is seen in present study compare with that of other 2 studies which had the ratio of 1:1. TLC count is seen much higher in other two studies compared to that of present study. Protein values is found lower in present study than compared to that of other two studies. Mean Glucose in the present study shows concordance with Aldriweesh M et al 2020. Jiménez Caballero et al 2011 study shows low mean glucose level of 25 mg/dl.

Table no. 4 Bacterial Meningitis Studies			
BACTERIAL MENINGITIS STUDIES	Jiménez Caballero et al 2011[5]	Aldriweesh M et al 2020 [6]	**PRESENT STUDY 2022**
AGE	55 +- 20	55.9 +- 15	44.67 +-20
MALE %	48%	50.90%	82.14%
TLC	1157+-200	828+-150	201+-261
PROTEIN	195.4	201.8	162.96
GLUCOSE	25+-15	44+-25	39.3+-18
GRAM STAIN	NA	100% POSITIVE	97% POSITIVE
ZN STAIN	NA	NA	0

(Table no. 5) In present study, mean age of the patients diagnosed with viral meningitis is 33 years which is in concordence with Aggarwal, J et al 2021 and Jiménez C, et al 2011. Mean age is 40 years in Viallon, A et al 2011 study. There is significant similarity in male to female ratio in Aggarwal, J et al 2021 and Viallon, A et al 2011 study when compared with present study. All other parameters in present study are showing concordance with other three studies.

Table no. 5 Viral Meningits studies				
VIRAL MENINGITIS	Jiménez C, et al 2011[5]	Aggarwal, J et al 2021[4]	Viallon, A et al 2011[7]	Present study
AGE	35+-18	32+-10	40+-23	33+-11
MALE %	53%	79.00%	89.00%	86%
TLC	181+-209	118+-90	115 +-77	206
PROTEIN	104.7+-123	76+-11	102+-62	91.74
GLUCOSE	55+-8	37+-17	82.08+-45	67
GRAM STAIN	0	0	0	0
ZN STAIN	NA	0	NA	NA

In this study we found a single case of fungal meningitis (Cryptococcal) which is confirmed on a KOH mount and negative staining . Patient is a 53 year old immunocompromised. The CSF leucocyte count of patient is 12 cells with 100% of lymphocytes, protein value of 15 mg/dl and glucose value 40 mg/dl.

In fungal meningitis diagnosis is difficult, as the CSF may be normal, with negative smears and sterile cultures, although more often there is at least one abnormality indicating disease.[8]

No case of tuberculous meningitis was found in this study.

Tuberculosis (TB) is a disease which has been affecting humanity since ages. Although tuberculous meningitis (TBM) is the least commonly observed form of extrapulmonary TB (5–15%), it is the most severe form in terms of mortality and morbidity. It develops as a late complication of primary infection. Mortality is frequently associated with a delay in diagnosis and treatment. [9, 10]

The symptoms observed at the time of admission in all type of meningitis were headache (86%), nausea,vomiting (64%), and

altered sensorium (59%). The most frequent finding was neck stiffness (88%).

Conclusion

CSF analysis is a important and useful investigation in patients having acute neurological conditions. It is mandatory in acute meningitis to identify the microbial organism or other cause, It will help as a supporting investigation to establish diagnosis , prognosticate and to assess the effects of different therapies to treat the patient.

Limitations

1. It is a retrospective study.
2. Data is not representative and small in number since our hospital is located in rural area.

Disclaimer

1. No special finding is received from any agency.
2. No conflict of interest intra or interdepartmental.
3. It is a retrospective record based study and ethical approval taken from IEC.
4. No identification of patients is revealed in any manner.
5. Sole purpose of this article is for academic purpose only.

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